

What is the minimum runway width in order to operate Airbus aircraft?

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Applicability

Performance Engineers Program (PEP) software / Takeoff and Landing Optimisation (TLO) module

FlySmart with Airbus Performance applications / TO PERF module

General Overview

Operators often ask "What is the minimum runway width required in order to operate Airbus aircraft?" because there is no limitation in most of Airbus AFMs.

Regulation only deals with maximum lateral displacement on a runway when a critical engine fails during takeoff. Except this requirement, regulations (certification and operational) do not define a minimum runway width for operation of civil transport aircraft.

This article indicates:

- A classification on the minimum runway width for Airbus aircraft according to ICAO annex 14
- What is basic and optional on the minimum runway width to operate Airbus aircraft.
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1 - Classification of Airbus Models According to ICAO Annex 14

Most civil aviation authorities define airport design standards based on ICAO Annex 14 and FAA specifications.

ICAO Annex 14 and FAA specifications contain International Standards and Recommended guidelines to be used for the planning and construction of airports. ICAO Annex 14 and FAA specifications do not define limits or regulate aircraft operations.

Based on ICAO Annex 14, the minimum runway widths recommended for the various Airbus aircraft are:

Aircraft	ICAO Min Rwy Width
A318/A319/A320/A321 with MTOW < 68T	30m
A319/A320/A321	45m
A300B/A300-600/A310	45m
A330/A340	45m
A380	60m*

(*) Note: Refer to **Chapter 4** for A380 operations on 45m wide runway.

For detailed information on Airbus aircraft classification according to ICAO Annex 14, refer to **#Appendix 3**.

2 - Minimum Runway Width to Operate Airbus aircraft

All Airbus aircraft are developed based on 45 m wide runways because it reflects the most frequently used runways by Airbus aircraft.

All flight and simulator certification tests linked to directional control on ground are performed on 45 m wide runways. These tests include:

1. Maximum demonstrated crosswinds at takeoff and landing on dry runway
2. Aircraft handling with degraded directional control on ground (e.g. rudder jammed, loss of nosewheel steering inoperative).

Based on the above Airbus practices, all Airbus aircraft can operate on 45 m wide runways under the conditions defined in the documentation (e.g. AFM, MMEL).

3 - Options on Minimum Runway Width to Operate Airbus aircraft

3.1 Requirements

Airbus aircraft A318/A319/A320/A321 with a MTOW<68T are compatible with 30m wide runways as per ICAO. However, due to Airbus practices to certify the aircraft, it is not possible to operate these aircraft on runway width below 45m without additional considerations.

In order to ensure equivalent safety margins on runway less than 45m wide, Airbus defined with Airworthiness Authorities new requirements in order to grant A318/A319/A320/A321 EASA Certification to operate on runways that are less than 45 m wide. Certification activities resulted to an AFM supplement that includes special procedures, limitations and performance corrections. For more information on the AFM supplement, refer to the #Appendix 4. The AFM supplement is covered through the Service Bulletin (SB) A320-00-1058 (MOD 30397).

Therefore, to operate Airbus aircraft A318/A319/A320/A321 on runway width below 45m, installation of the Service Bulletin (SB) A320-00-1058 (MOD 30397) is required. In addition, an authorization from the National Authority (NA) is also required because NA may require Operator to consider additional operational parameters (e.g. Operator experience, visibility, human factors).

For A300/A310 and A330/A340 aircraft, 45m is the minimum runway width recommended as per ICAO. For operations on runway width less than 45m, Airbus can provide Operators with an assessment on case by case basis that takes into account ICAO recommendations, runway characteristics, and aircraft characteristics.

Note: Modification 30397 can be retrofitted to any A320 Family aircraft through Service Bulletin A320-00-1058. This modification affects the documentation only, and no aircraft physical modification is required. When the aircraft modification (Mod 30397) applies to an aircraft, the Operator receives the relevant AFM supplement and FCOM updates. In order to obtain the cost of the embodiment of MOD 30397, the Operator can contact the Customer Support Director (CSD).

3.2 - Performance Aspects

Operation on a narrow runway is based on different takeoff performance certification basis. In the case of an engine failure the maximum lateral deviation is reduced to 20ft (6.5m). The 20ft maximum deviation was derived by factoring the 30ft (deviation of EASA CS 25.149(e) by the ratio of the runway widths (30ft*30m/40m). The objective was to ensure equivalent safety margins on narrow runway as with the 45m wide runways.

Note: For detail information about certification requirement EASA CS 25.149(e) that deals with lateral displacements on the runway, refer to #Appendix 3.

Reducing the lateral deviation leads to:

- Increase the VMCG by up to 2.5kt between 30m and 40m wide runway
- Reduce the takeoff performance limited weight when the takeoff performance is VMCG limited.

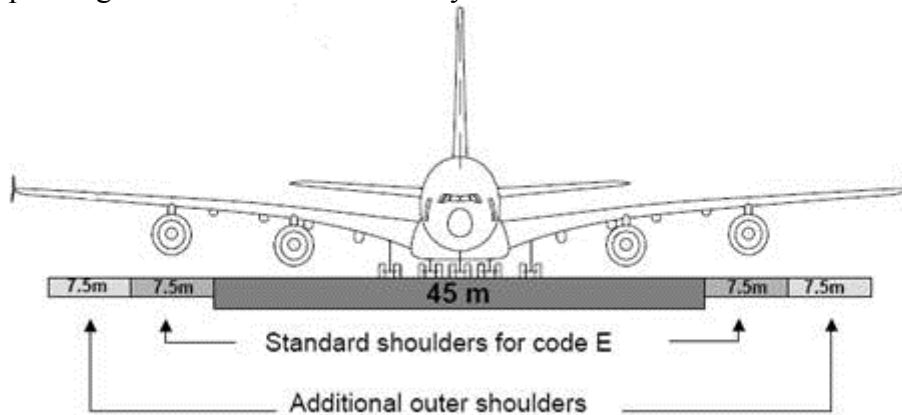
To enable the assessment of takeoff performance, the low speed performance database must include the “Narrow Runway” option. The performance tools (TLO and TO PERFO) automatically account for narrow runway performance corrections (i.e. VMCG increase) provided the runway width is correctly set. The #Appendix 1 presents the method to calculate takeoff performance with TLO and TO PERF for narrow runways.

4 - A380 Aircraft Operations

4.1 Requirements

The minimum certified runway width for A380 takeoff and landing is 45 m (150ft).

On 45 m (150 ft) wide runway, the outer engines may be above non-stabilized surface depending on the width of the runway stabilized shoulders.



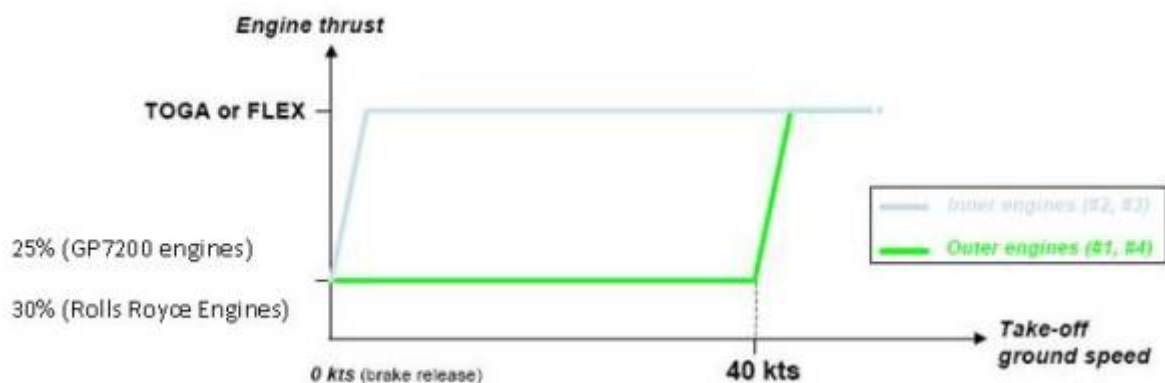
Note: See #Appendix 3 for code E definition.

The standard shoulders can be paved or in natural surface (e.g. grass without loose gravel), or not stabilized (i.e. sand, loose gravels, snow).



When the runway plus stabilized shoulders is above 58m wide, the basic Standard Operating Procedure (SOP) given in the Flight Crew Operating Manual (FCOM) applies.

When the runway plus stabilized shoulders is less than 58m wide, a specific takeoff procedure applies in order to protect the outer engines against Foreign Object Damage (FOD). This procedure consists in setting the outer engines thrust to TOGA/FLEX only when the aircraft speed is at 40kts as illustrated below. This special procedure is published in the AFM and FCOM.



4.2 Performance Aspects

When the runway plus stabilized shoulders is less than 58m wide, the specific thrust setting increases the takeoff distances (TOD, TOR, ASD). The takeoff performance penalty is valid for dry, wet, and contaminated runways.

The performance tools TLO and TO PERF automatically account for runway+shoulders < 58m performance penalties provided the runway width and shoulder is correctly set for the applicable runways.

The #Appendix 2 presents the method to consider runway+shoulders < 58m performance penalties with TLO and TO PERF.

Appendix 1: Narrow Runway Implementation with Performance Tools

TLO and TO PERF automatically account for narrow runway performance corrections (i.e. VMCG increase) provided the runway width is correctly set. The following paragraph presents the method to calculate takeoff performance with TLO and TO PERF for narrow runway.

Using the PEP

Step 1 Open / Create a TLO session

Step 2 In the "Runway" panel, click on the runway

Step 3 Check / Set the Runway Data Width

The screenshot shows the 'Airport' configuration dialog box. The 'Runway identification' section includes fields for Airport name (FLORENCE / PERETOL), ICAD Code (LIRQ), IATA Code (FLR), and Runway ID (23). The 'Runway data' section includes fields for Geometric elev. (R) (144), TORA (m) (1674), TODA (m) (1779), ASDA (m) (1674), and Runway slope (%) (-0.4). The 'Width' checkbox is checked and highlighted in yellow, with the value '30' entered in the adjacent field. The 'Obstacle reference' is 'Beginning of TORA' and the 'Number of obstacles' is '6'. A table of obstacles is displayed with columns for N°, Distance (m), Height (ft), and Lat. dist. (m). The table contains six rows of obstacle data, all with checked checkboxes. The 'Comments' field contains the text: 'At "TOSCO" 18 DME R 224 PRT 112.5 enter HLDG (044 INBD, RT)'. The dialog box has 'OK' and 'Cancel' buttons at the bottom right.

	N°	Distance (m)	Height (ft)	Lat. dist. (m)
<input checked="" type="checkbox"/>	1	1785	-13	0
<input checked="" type="checkbox"/>	2	1890	0	0
<input checked="" type="checkbox"/>	3	2310	36	0
<input checked="" type="checkbox"/>	4	3030	59	0
<input checked="" type="checkbox"/>	5	3885	126	0
<input checked="" type="checkbox"/>	6	11700	847	0
<input type="checkbox"/>	*			

Two Cases:

Case 1: The runway "width" data is not ticked.

A close-up of the 'Width' checkbox, which is currently unchecked. The checkbox is located in the 'Runway data' section of the configuration dialog box.

In such a case, no narrow runway performance correction are taken into account for the calculation.

*Note: When an Airport database is used, if the runway width for a selected runway is not set (i.e. empty), the width data box is not ticked. As a result, TLO considers that **no** narrow runway performance correction applies.*

Case 2: The runway "width" data is ticked and the runway width is set to a value that is above or equal to 30m and below 40m.

In such a case, narrow runway performance corrections apply. A message appears on the RTOW chart (e.g. DVMCG due to rwy width = 30.0 m) or in the TLO Output data file to indicate that the VMCG is corrected due to non standard runway.

Note:

- *TLO does not permit a runway width below 30m*
- *Above 40m runway width, no message appears on the RTOW chart or in the output file since no performance penalty applies for narrow runway.*

Using TO PERF

TO PERF uses airport data initially defined by the administrator (e.g. Airport Manager application).

Therefore, if the runway width for a selected runway is not set (i.e. empty) by the administrator, TO PERF considers that the runway width is above 40m.

If the runway width data is set to a value below 40m, TO PERF automatically accounts for narrow runway performance corrections. No message appears in the takeoff results about the VMCG corrected due to non standard runway.

Appendix 2: A380 Rwy + Shoulders < 58m Implementation with the Performance Tools

TLO and TO PERF automatically account for runway+shoulders < 58m performance penalties provided the runway width and shoulder have been correctly set.

Using the PEP

Step 1 Open / Create a TLO session

Step 2 In the "Runway" panel, click on the runway

Step 3 Check or tick the Runway + Hard shoulder width < 58m according to airport and runway

Airport

Runway identification

Airport name: TOULOUSE / BLAGNAC
 ICAO Code: LFBD
 IATA Code: TLS
 Runway ID: 14L

Obstacle reference: Beginning of TORA
 Number of obstacles: 5

	N°	Distance (m)	Height (ft)	Lat. dist. (m)
<input checked="" type="checkbox"/>	1	3380	37.8	0
<input checked="" type="checkbox"/>	2	4035	70.8	0
<input checked="" type="checkbox"/>	3	11290	464.8	0
<input checked="" type="checkbox"/>	4	13520	542.8	0
<input checked="" type="checkbox"/>	5	13890	565.8	0
* <input type="checkbox"/>				

Runway data

Geometric elev. (ft): 490
 TORA (m): 3000
 TODA (m): 3100
 ASDA (m): 3000
 Runway slope (%): 0.1

Width: 45

Runway + hard shoulder width < 58m

OK Cancel

PEP Anomaly: Management of the "Runway + hard shoulder width <58m" tick box during the computation of takeoff charts.

During the computation of takeoff charts, and when several runways are selected, the PEP 4.5 software does not correctly manage the "Runway + hard shoulder width <58m" tick box. The consequence of this issue is that the same computation option is applied to all runways.

Although the selection of the "Runway + hard shoulder width <58m" option does not work properly, the produced takeoff charts are correct, i.e.: When "Rwy + stab shoulder width <58m" appears in the upper left cartridge of the RTOW chart, the performance penalty is taken into account.

Until a corrective version of the PEP is available, if Operators need to produce takeoff charts for backup purpose, Operators should apply the following:

1. *Run a first computation with the "Runway + hard shoulder width <58m" option ticked on one of the runway selected*
2. *Run a second computation with the "Runway + hard shoulder width <58m" option not ticked on one of the runway selected*
3. *Manually sort out the takeoff charts depending on the effective runway + stabilized shoulder width*
4. *Check the effective computation option in the produced takeoff charts in upper left cartridge.*

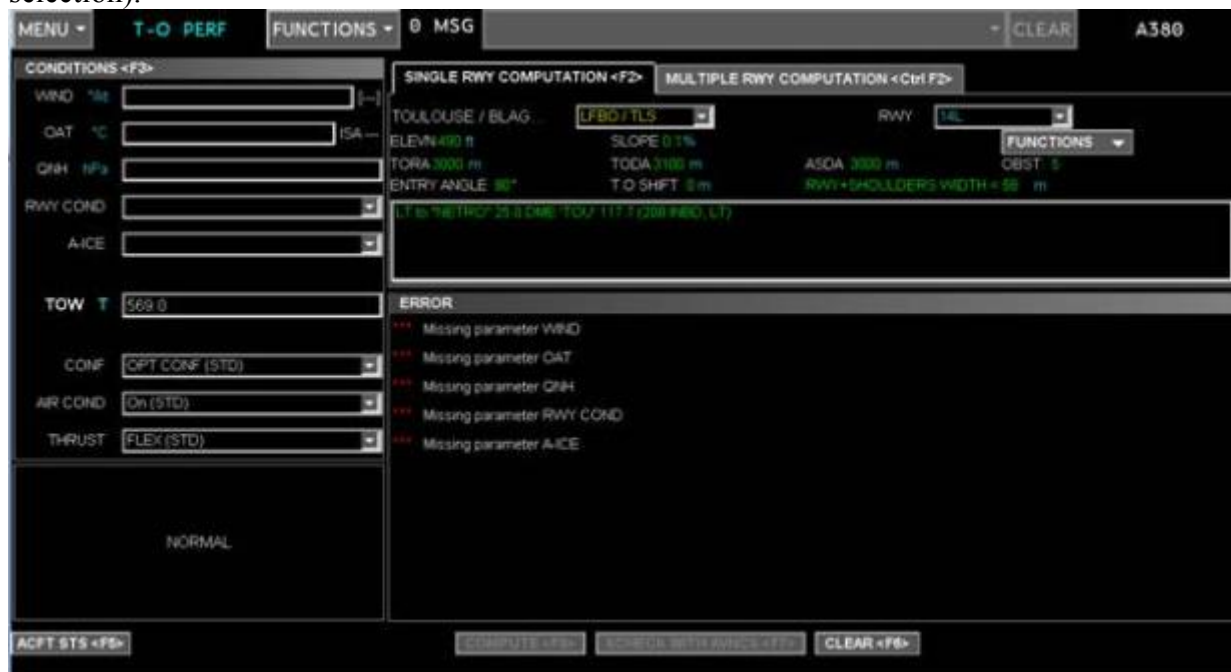
A future version of PEP will correct this issue.

Using TO PERF

TO PERF uses airport data initially defined by the administrator (e.g. Airport Manager application).

If the sum of the runway + shoulders width data is below 58m, TO PERF module automatically accounts for runway performance corrections. The message "RWY+SHOULDERS WIDTH < 58m" appears in the takeoff panel (i.e. below the RWY

selection).



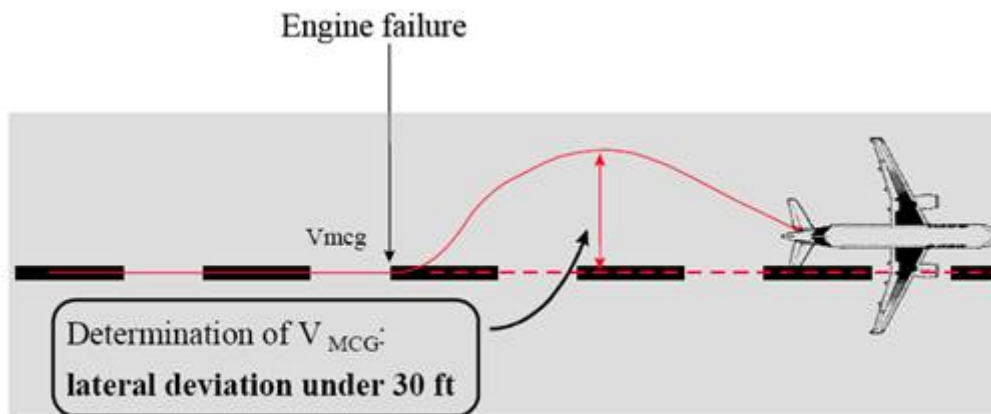
Appendix 3: Regulatory Frameworks

3.1 - Certification Requirements

From an airworthiness point of view, the Certification Requirements for Large Transport Aircraft are FAR 25 and EASA CS-25. Both regulations are currently very similar in their contents and in their interpretation.

There is only one paragraph (25.149(e)) which deals with lateral displacements on the runway:

"(e) VMCG, the minimum control speed on the ground, is the calibrated airspeed during the take-off run, at which, when the critical engine is suddenly made inoperative, it is possible to maintain control of the airplane with the use of the primary aerodynamic controls alone (without the use of nose-wheel steering) to enable the take-off to be safely continued using normal piloting skill.... In the determination of VMCG, assuming that the path of the airplane accelerating with all engines operating is along the centerline of the runway, its path from the point at which the critical engine is made inoperative to the point at which the recovery to a direction parallel to the centerline is completed, may not deviate more than 30 ft (9.144 m) laterally from the centerline at any point."



The VMCG is defined as the speed which, when one engine fails, leads to a lateral deviation of 30 ft when controlling the aircraft with aerodynamic means only.

Other than the requirement of 25.149(e), neither of these two basic Certification rules deals with the runway width on which the aircraft is operated. Therefore, neither FAR 25 nor EASA

CS-25 prevents the operation of a given aircraft on a narrow runway. This is the reason why there is no minimum runway width in most Airbus AFMs.

3.2 - Airport Design Regulation

ICAO Annex 14 and FAA specifications provide guidelines to be used for airports planning and construction. These documents do neither define limits nor regulate the operation aircraft but provide guidelines to airport planners on the width of the runway to be built considering the characteristics of the aircraft to be operated on it.

The aircraft classification used in airport design standards is primarily based upon aircraft dimensions, although the FAA and ICAO base their classifications on different criteria. The following paragraphs present the classification of Airbus models as per ICAO Annex 14.

ICAO Annex 14 Volume 1, Chapter 1.3 defines an Aerodrome Reference Code that relates the performance characteristics and geometrical dimensions of the aircraft intended to be used on the given runway. Based on this Aerodrome Reference Code, chapter 3.1.9 defines the minimum runway widths.

3.3 - ICAO Annex 14: Aerodrome Reference Code

The Aerodrome Reference Code is defined by: a code number related to aircraft performance, and a code letter related to aircraft geometrical characteristics. These codes are defined as follows:

Code Element 1		Code Element 2		
Code Number	Airplane Reference Field Length	Code Letter	Wing Span	Outer main Gear Wheel span
1	Less than 800 m	A	Up to but not including 15 m	Up to but not including 4.5 m
2	800 m up to but not including 1200 m	B	15 m up to but not including 24 m	4.5 m up to but not including 6 m
3	1200 m up to but not including 1800 m	C	24 m up to but not including 36 m	6 m up to but not including 9 m
4	1800 m and over	D	36 m up to but not including 52 m	9 m up to but not including 14 m
		E	52 m up to but not including 65 m	9 m up to but not including 14 m
		F	65 m up to but not including 80 m	14 m up to but not including 16 m

Airplane Reference Field Length is the minimum field length required for takeoff at maximum certified takeoff weight, sea level, ISA conditions and zero runway slope.

Outer Main Gear Wheel span is the distance between the outside edges of the main gear wheels.

3.4 - ICAO Annex 14: Minimum Runway Width

ICAO Annex 14 defines the minimum runway width by reference to the Code number and Code letter as follows:

Code Number	Code Letter					
	A	B	C	D	E	F
1	18m	18m	23m	--	--	--
2	23m	23m	30m	--	--	--
3	30m	30m	30m	45m	--	--
4			45m	45m	45m	60m

3.5 - Classification of Airbus Models According to ICAO Annex 14

Based on ICAO Annex 14, all Airbus aircraft are code number 4. The only exception is for A318/A319/A320/A321 aircraft that can be considered as code number 3 when the Maximum Takeoff Weight (MTOW) is lower than 68t.

The geometrical data of the different Airbus aircraft, and the corresponding ICAO code letter are given in the following table:

Aircraft	Wing Span	Outer Main Gear Wheel Span	Code Letter
A318/319/320/A321/A319/	34.1	8.9	C
A310	43.9	11.0	D
A300B/A300-600	44.8	11.1	D
A330/A340-200/300	60.3	12.6	E
A340-500/600	63.4	12.6	E
A380	79.8	14.3	F

Based on the above code numbers and letters, the minimum runway width recommended by ICAO Annex 14 for the various Airbus models are:

Aircraft	Code Number	Code Letter	ICAO Min Rwy Width
A318/A319/A320/A321 with MTOW<68T	3	C	30m
A319/A320/A321/A319	4	C	45m
A300B/A300-600/A310	4	D	45m
A330/A340	4	E	45m
A380	4	F	60m*

(*) Note: Refer to #Chapter 4 for A380 operations on 45m wide runway.

Appendix 4: AFM Supplement when A/C fitted with MOD 30397

The following is an example of the AFM supplement, and is for information only.



A318/A319/A320/A321
AIRPLANE FLIGHT MANUAL

APPENDICES AND SUPPLEMENTS
NARROW RUNWAY

GENERAL

Ident.: APP-NRWY-00006985.0001001 / 23 NOV 09
Criteria: SA

EASA APPROVED

The nominal runway width for operations of the aircraft is 45 m. Operations on runways with a width below 45 m are covered by modification 30397.

GENERAL

Ident.: APP-NRWY-00006985.0002001 / 23 NOV 09
Criteria: (SA and 30397)

EASA APPROVED

This supplement is applicable to operations on runways with a width below 45 m.
This supplement does not constitute an operational approval. Such authorization must be obtained by the operator from the appropriate authorities.
Unless amended in this supplement, all the chapters of this AFM remain applicable.

LIMITATIONS

Ident.: APP-NRWY-00006987.0001001 / 23 NOV 09
Criteria: (SA and 30397)

EASA APPROVED

Minimum runway width: 30 m

Systems:

The dispatch from/to narrow runways is not allowed in case of:

- nosewheel steering inoperative
- one brake or more inoperative.

Autoland is not allowed.

PROCEDURES

Ident.: APP-NRWY-00007014.0002001 / 23 NOV 09
Criteria: (SA and (26925 and 30397))

EASA APPROVED

Diversion to a 45 m wide runway is recommended in case of:

- rudder jam
- rudder pedal jam
- yaw damper fault
- all failures leading to the loss of the nosewheel steering (HYD Yellow system loss, double hydraulic failure, double BSCU fault, double LGCIU fault).

The following applies to narrow runways in terms of crosswind component:

- Maximum demonstrated crosswind for dry runways: 38 kt (gust included) for takeoff and landing
- Maximum demonstrated crosswind for wet runways: 33 kt (gust included) for takeoff and landing
- Maximum crosswind for contaminated runways: 10 kt (gust included) for takeoff and landing.

Note: These values are based on the assumption that crew have been trained accordingly.

Operations on icy runways have not been demonstrated.

PERFORMANCE

Ident.: APP-NRWY-00006986.0002001 / 23 NOV 09
Criteria: (SA and 30397)

EASA APPROVED

For performance determination, the Performance Engineer's Programs AFM_OCTO approved FM module at the latest approved revision must be used.

Refer to *PERF-OCTO Performance Database*.

Enter the runway width in the RUNWAY WIDTH field of the input data for AFM performance calculation.

For runways with a width below 40 m, the VMCG must be increased by:

Runway width	30 m	35 m	40 m
Δ VMCG (kt)	+2.5	+1.5	+0

and linear interpolation in between.

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